Skinner Lake Aquatic Vegetation Management Plan Prepared for the Skinner Lake Association

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Funded by Lake and River Enhancement (LARE) and Skinner Lake Association.

Executive Summary

Aquatic Weed Control was contracted by Skinner Lake Association to develop a long term lake wide management plan. Funding for this plan was provided by the Skinner Lake Association and the Department of Natural Resources Division of Soil Conservation. This funding was part of the Lake and River Enhancement (LARE) program. Aquatic Weed Control was contracted to conduct two aquatic vegetation surveys in order to characterize the plant community of Skinner Lake. Following protocol established by the Indiana Department of Natural Resources, a qualitative survey called the tier I reconnaissance survey was used to obtain an understanding of the vegetation present in Skinner Lake. Next, a quantitative survey (tier II) was used to document the distribution and abundances of individual plant species in Skinner Lake.

Based upon the data collected in the aquatic vegetation surveys, a management plan was proposed that should help to alleviate major problems caused by invasive aquatic plants. This lake management plan is a requirement to receive additional funding to treat the lake for invasive aquatic vegetation.

In the tier II quantitative survey six major species of aquatic plants were identified, including coontail, naiad, Eurasian milfoil, curly leaf pondweed, Illinois pondweed and sago pondweed. Of these species, Eurasian milfoil and curly leaf pondweed are of special concern because they are very aggressive, invasive species. These plants threaten the biodiversity of the lake and cause problems with fishing, swimming, boating and the overall use of the lake by residents and non-residents. This report recommends an early season treatment of Aquathal to control these invasive species. Aquathal has been shown to effectively control curly leaf pondweed by reducing its reproductive capability. Aquathal should greatly reduce the number of turions (reproductive structures of curly leaf pondweed) remaining in the soil from year to year. This management plan is expected to cost approximately 12,000 dollars annually for treatments in 2005, 2006, and 2007. Turion survey costs would be approximately 750 dollars per survey. These treatments should greatly reduce the threat of invasive species to the Skinner Lake ecosystem.

Turion production of curly leaf pondweed will be monitored from year to year and steps will be taken to inform the public about management practices on Skinner Lake.

Acknowledgements

Aquatic vegetation surveys conducted on Skinner Lake were made possible by funding from the Indiana Department of Natural Resources and the Skinner Lake Association. Aquatic Weed Control would like to extend special thanks to Indiana Department of Natural Resources (IDNR) District 3 biologist Jed Pearson for providing procedural training for both tier I and tier II aquatic vegetation surveys. Jed Pearson also provided assistance and consultation in generating plant distribution maps for Skinner Lake. Cecil Rich, aquatic biologist for the IDNR Division of Soil Conservation provided valuable consultation regarding the requirements and objectives of this lake management plan. Jed Pearson and Cecil Rich both reviewed this management plan and provided suggestions for revision. Also, special thanks to Brad Fink, assistant fisheries biologist for the IDNR, for providing training in data analysis programs for the tier II quantitative vegetation surveys. Jim Donahoe and David Keister of Aquatic Weed Control performed the aquatic vegetation sampling and are the authors of this report. Aquatic Weed Control would also like to thank the members of the Skinner Lake Association for their commitment to improving this lake and for valuable discussion and input brought forward at the public information meeting held on November 23, 2004.

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Introduction

Aquatic Weed Control was contracted by the Skinner Lake Association to develop a long-term lake wide management plan. Funding for this report was provided by the Skinner Lake Association and the Department of Natural Resources Division of Soil Conservation. This funding was part of the Lake and River Enhancement (LARE) program.

When a person registers a boat within the state of Indiana a lake enhancement fee is included in the cost of registry. One third of this money is then used to provide funding for projects designed to improve the quality of Indiana lakes by controlling invasive plant species. These surveys included in this report, as well as the management plan, are required by the state to receive additional funding to treat the lake for exotic aquatic vegetation. Should a lake be selected for LARE funding, up to 100,000 dollars can be given for a whole-lake treatment with a cumulative 3-year maintenance total of an additional 20,000 dollars. If the whole lake is not treated, up to 20,000 dollars can be available annually for up to three years. Requests for funding are reviewed by the Indiana Soil Conservation Board, and funds will be distributed at their discretion.

This project was initiated to take a more aggressive and long-term approach to controlling the curly leaf pondweed in Skinner Lake. Curly leaf pondweed chokes the lake in spring and early summer. Although individual lots have been managed for curly leaf pondweed, the action plan outlined in this report should provide better control over this invasive species, for a longer period of time.

Problem Statement:

Skinner Lake, located in central Noble County, is in need of intervention to restore a healthy plant community and enhance recreational opportunities for all lake users.

Curly leaf pondweed, an exotic aquatic plant, grows and spreads rapidly each year in early spring. This weed, along with the native coontail form large dense weed beds that ring the lake by late spring making it nearly impossible for lake residents to enjoy activities such as swimming, fishing and boating.

In addition to suppressing the recreational value of this lake, the dense beds formed by curly leaf pondweed may contribute to fish stunting, and the weed is undoubtedly robbing important native plants species of the light and nutrients they need to survive.

In the past some individuals owning property along the lake's shoreline chose to chemically treat curly leaf pondweed on an "as needed" basis, but no lake wide management strategy has ever been implemented to control the invasive curly leaf pondweed.

Water quality is also of major concern on Skinner Lake. This lake's large watershed (10,000 acres) drains large quantities of nutrients from agricultural land and sewer systems that result in poor water clarity, reducing plant growth to a depth of about 4 feet (Pearson, 2005). Fortunately, a lake wide sewer system has been established, which will help to

alleviate some problems, but poor water quality will continue to be a problem in the near future.

In short, the presence of the curly leaf pondweed is reducing plant diversity and the health of the lake ecosystem while severely limiting recreational use of the lake.

Management Goals:

A responsible management strategy for this lake will have two main goals.

1. Restore a healthy and well-diversified plant community in Skinner Lake.

2. Increase and enhance recreational opportunities at Skinner Lake.

To reach these goals we need specific objectives that will help us achieve them. To restore a well diversified plant community we first need to control the invasive species that pose a threat to the overall biodiversity of this lake. The lake has a minor Eurasian milfoil problem and a major curly leaf pondweed problem. The main objective of the action plan outlined in this report is to provide effective and long term control of curly leaf pondweed.

Controlling the curly leaf pondweed will also help to enhance recreational opportunities on Skinner Lake. In spring and early summer, this weed rings the lake, making swimming boating and fishing very difficult. Reducing the amount of curly leaf pondweed will provide better opportunities for these activities and allow native plants to grow in areas where they have long been excluded.

The success of these objectives can be measured on an annual basis through sampling the amount of curly leaf pondweed turions left in the sediment after each chemical application. These surveys will be used to evaluate the effectiveness of the action plan.

In the past, the lake was treated each year with a contact herbicide in June and August to provide temporary relief from exotic species. While this treatment was beneficial to those wishing to use the lake for recreation, a large portion of the spring was "lost" because exotics were already choking the lake long before the June treatments. In addition, treatments with a contact herbicide are only effective on existing weeds, offering little chance of true long-term control. This management plan should provide a more effective control of curly leaf pondweed over a longer period of time. This plan is designed to be adaptive, and an important part of the management process will be to monitor the degree of invasive plant control gained by management practices. The action plan can be altered based upon its success.

The data collected during this management process will help to provide a lake management history that can be used to construct more effective and more efficient management plans in the future. In addition to providing short-term relief from invasive plants, lessons learned from this action plan will serve as a basis for maintaining a well diversified plant community for years to come.

An important part of the action plan will be to provide avenues for all lake users to learn about the invasive species in Skinner Lake and about the management techniques that have been implemented to control them. Well publicized public meetings can be used as a tool to inform the public about the action plan, but lake users who do not live close to the lake will not likely attend these meetings. Posters or signs posted at the public boat landing may also help to inform lake users who may only visit the lake once or twice a year. Also, a brief summary of lake management practices made possible by public funds would be an excellent addition to the annual fishing regulations booklet distributed by the IDNR.

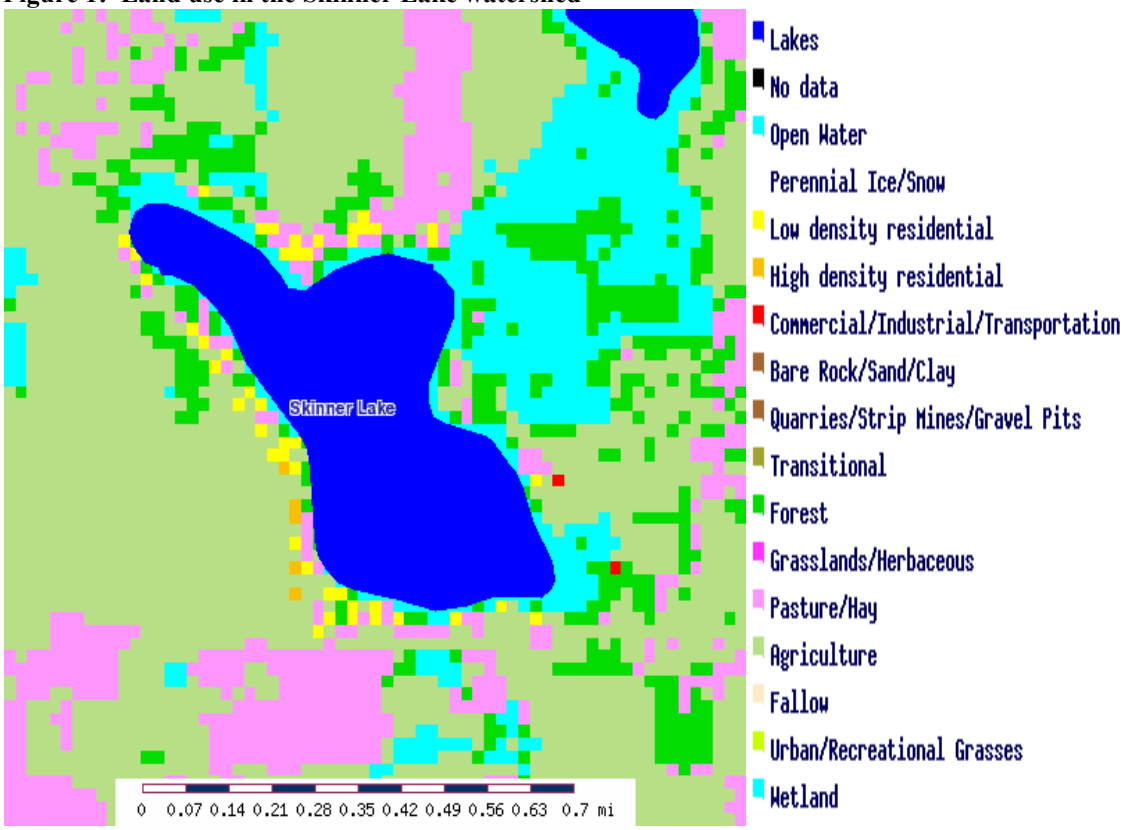
Watershed and Water Body Characteristics

Skinner Lake is located in central Noble County in Northeast Indiana. It has 125 surface acres with a maximum depth of 32 feet and an average depth of 14.0 feet. This moderately eutrophic lake has an extremely large watershed for a lake of its size. The lake drains 10,000 acres, most of which is used for agricultural purposes. Large amounts of agricultural activity in this watershed make Skinner Lake prone to heavy sediment loading, with visibility decreasing to less than 3 feet at times of heavy runoff (Tyllia, 2002).

Nearly 95% of Skinner Lake's shoreline is developed, which can also cause complications in the form of sewage, storm water and fertilizers entering the lake. This problem has been partially corrected with the installation of a new lake wide sewer system. High nutrient levels in the lake cause significant plankton blooms in spring and summer, which also reduce water clarity (Tyllia, 2002).

The characteristics of its watershed make Skinner Lake very susceptible to over-abundant weed growth, and especially to aggressive, fast growing exotic plants that thrive in moderately turbid water. The following map gives the land usage and shows the inlet streams that are contributing to the phosphorus loading in the lake. This plan is designed to manage aquatic vegetation in the lake and not the watershed.

Figure 1: Land use in the Skinner Lake watershed



http://pasture.ecn.purdue/~watergen

Present Water Body Uses:

Today, Skinner Lake is highly valued to many stakeholders for a number of reasons. This lake has daily skiing hours, which permits owners of fast moving jet skis and ski boats to use the lake while also reserving time for peace and quiet for slower moving boats and fisherman.

Over-abundant panfish populations prompted the IDNR to begin stocking hybrid muskellunge in 1986, and yearly additional stockings maintain an excellent population of this unique and highly valued sport fish. (IDNR: Fisheries Survey, 1998)

Located just off of state road 8 just outside of Albion, Skinner Lake has a state-owned public access that opens this lake to thousands of residents living in the surrounding area. The residents around this lake share it with the general public, and it is important to note that any management practices implemented on this lake will benefit an extremely large number of people due to the accessibility of this lake. The primary water body uses occur around the shoreline of the lake.

Skinner Lake Fisheries

The most recent fisheries survey conducted by the Indiana Department of Natural Resources took place on June 31, 1998. Data was obtained by using electro- fishing and gill nets to collect, count, measure, and then release fish. A total of 18 species of fish were collected, many of which were valuable game fish.

Skinner Lake has a history of problems with fish stunting. This is reflected in the IDNR's fisheries survey. Out of 988 bluegills sampled, not one fish exceeded 8 inches. Also out of 411 black crappies sampled, 313 fish (76.2%) measured between 6 and 8 inches, a size generally considered very small for crappies. (IDNR Fisheries Survey, 1998).

This is not to say that Skinner Lake does not have a valuable fishery. One could argue that this is one of the most valuable fisheries in northeast Indiana. In fact, many anglers seeking a lake with good numbers of panfish frequent this lake, via the public access on the southwest shore. Also, the high density of panfish means that the predators that prey on these fish have an almost unlimited food source. Large mouth bass size is good, with fish measuring over 20 inches collected during this survey.

High densities of panfish have made Skinner Lake an excellent location for stocking hybrid muskellunge (tiger muskies). These fish were introduced beginning in 1986, and at least 450 have been added every year since. The hope is that these fish will reduce panfish populations and increase panfish size, while creating an excellent muskellunge fishery that will attract anglers. Lakes stocked with tiger muskies are rare in Indiana, but the DNR's long-term efforts have created an excellent musky fishery, and have made Skinner Lake an even more valued fishery. A summary of the 1998 survey is included in the following table.

Table 1: Skinner Lake Fisheries Survey. (IDNR, 1998.)

Species	Total # Collected	Percentage	Size Range (in.)
Bluegill	988	55.5	1.6-8.0
Black Crappie	411	23.0	3.6-13.7
White Crappie	110	6.2	4.6-14.4
Spotted Gar	68	3.8	15.5-33.3
Largemouth Bass	64	3.6	5.4-20.4
Yellow Perch	40	2.2	4.5-9.7
White Sucker	21	1.2	5.7-19.8
Yellow Bullhead	20	1.1	10.0-13.8
Pumpkinseed	18	1.0	4.1-7.4
Golden Shiner	9	0.5	5.8-8.4
Brown Bullhead	8	0.4	4.3-14.9
Warmouth	7	0.4	3.2-7.7
Carp	6	0.3	21.6-28.5
Hybrid Muskellunge	4	0.2	21.3-31.2
Redear Sunfish	3	0.2	6.8-7.1
Golden Redhorse	2	0.1	17.8-19.5
Hybrid Sunfish	1	0.1	6.2
Lake Chubsucker	1	0.1	9.6

There is no question that the health of the plant community and the health of the fish community are linked. The results of the tier II quantitative plant survey indicate that Skinner Lake has very low plant diversity. Only six major species of plants were found, and of those, two species are invasive plants that provide poor fish habitat. Poor water quality and poor plant diversity have a negative impact on fish populations. This action plan should help the overall biodiversity of the lake by reducing exotic plants and giving beneficial native plants a chance to reclaim the lake. Once the native plants are re-established they can help remove excess nutrients from the water, increasing water quality and increasing the overall health of the ecosystem.

Characterization of the Plant Community:

Major weed beds were located visually from a boat. The exact locations of the weed beds were recorded using a WAAS enabled GPS unit and these locations were used to generate the following map using Delorme Street Atlas 2004. Figure 2 represents the major plant bed locations for the tier I survey.

Figure 2: Tier I major plant bed locations

Skinner Lake Tier I Survey Methods

The tier I reconnaissance survey is designed to identify the major plant beds present in a body of water. This is a qualitative survey designed to give an overview of the aquatic vegetation present in a lake. It identifies and documents problem areas that can be targeted when management practices are implemented. Major submersed plant beds are found visually from a boat. Each bed is given a reference number that is recorded on tier I data sheets. The general location of these beds are recorded on a bathymetric map of the lake, and more precise locations are recorded on tier I data sheets with the help of a WAAS enabled GPS unit.

When a major plant bed is identified, each species of plant found in that bed is recorded. Canopy ratings are given to each plant bed based on the types of plants present in that bed. The four major types of plants to be identified in this study are as follows: submersed

plants, emergent plants, non-rooted floating plants and rooted floating plants. The following scale is used to describe these four types of plants based on the percentage of the plant bed canopy they occupy:

Canopy Rating

1 = <2% of canopy
2 = 2-20%
3 = 21-60%
4 = >60% of canopy

In addition to the canopy rating, another abundance rating is given to each individual species found in a particular plant bed. This abundance rating is based on the percentage of the entire bed area that species appears to occupy. The scale for this abundance rating is the same as the canopy rating scale. The difference is that this scale identifies the abundance of *individual species* in the bed:

Species Abundance Rating

1 = < 2% of the bed
2 = 2-20%
3 = 21-60%
4 = >60% of the bed

Since this is a visual survey, results are dependant upon the surveyor's ability to locate plants below the water's surface. Tier I surveys are much more challenging in lakes with low secchi disk readings. Polarized glasses were used to reduce glare from the sun and enable the surveyors to see more easily into the water. Even with the aid of polarized glasses, the tier I survey should not be considered an exhaustive survey of aquatic vegetation. The tier I survey is a tool that helps to provide an overall picture of an aquatic plant community when coupled with the tier II quantitative survey.

During the tier I survey of Skinner Lake six major plant beds were found. Five species of aquatic plants were identified, and their abundances at each bed were recorded. Below is a summary of the plants found at each major bed.

Tier I Plant Bed Summary

Plant Bed #1:
This was a large bed with an approximate size of 2 acres. Two plant species were observed at this bed. Eurasian milfoil was present with an abundance rating of 3 while curly leaf pondweed was present with an abundance rating of 1.

Plant Bed #2
This plant bed had an approximate size of 1 acre and was also composed of just Eurasian milfoil and curly leaf pondweed. Eurasian milfoil had an abundance rating of 3 while curly leaf pondweed had an abundance rating of 1.

Plant Bed #3
This was a relatively small bed with a size of approximately 1/10 acre. Again the only species found in this bed were Eurasian milfoil and curly leaf pondweed. Eurasian milfoil had an abundance rating of 3 and curly leaf pondweed had an abundance rating of 1.

Plant Bed #4
This plant bed was approximately ¼ acre in size and was composed of two species: Eurasian milfoil and white water lily. Eurasian milfoil had an abundance rating of 3 and white lily had an abundance rating of 2.

Plant Bed #5
This was another very small bed with a size of only 1/10 acre. It was composed of only one plant species. This species was the native plant, Illinois Pondweed and it had an abundance rating of 2.

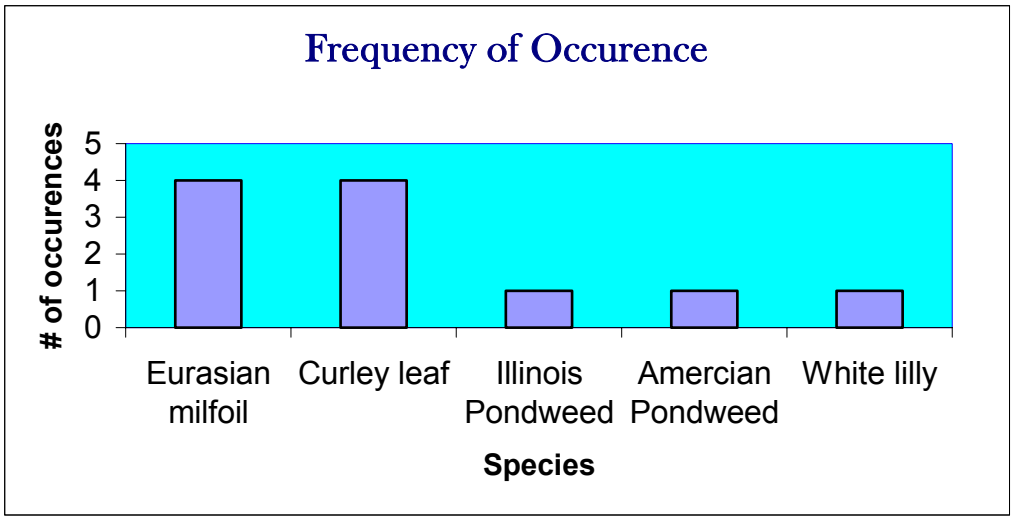
Plant Bed #6
This bed was small as well, with a size of 1/10 acre. The native American pondweed and the invasive curly leaf pondweed were the only two plants present in this bed. American pondweed had an abundance rating of 2 while the curly leaf pondweed had an abundance rating of 1.

** It is important to note that curly leaf pondweed is much more prevalent in spring and early summer. As water temperatures approach 70 degrees Fahrenheit, curly leaf pondweed begins to die out for the year. When this survey was conducted in late August, much of the curly leaf pondweed had already died out.

Frequency of Occurrence:

The graph below illustrates how many times each plant species was observed during the tier I survey. Curley leaf pondweed and Eurasian water milfoil were both present in four of the six beds. Illinois pondweed, white lily and American pondweed were all present in just one of the six plant beds.

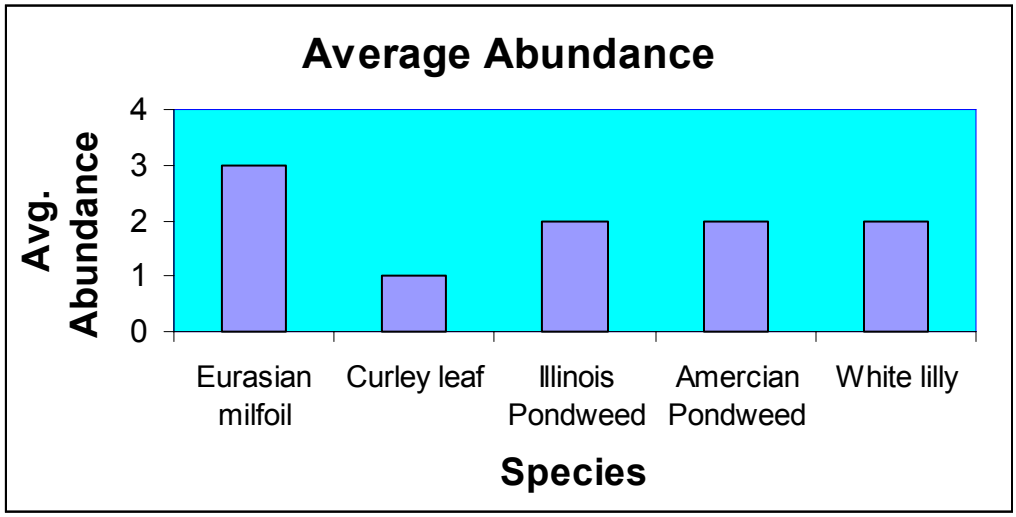
Table 2: Tier One Frequency of Occurrence.



Average Abundance:

The graph below shows the average abundance of each species in Skinner Lake. Eurasian Milfoil was most abundant and had an abundance score of three wherever it was found. American pondweed, white lily, and Illinois pondweed only occurred once and each had an abundance score of two. Curley leaf pondweed occurred four times yet had an average abundance of only one.

Table 3: Tier One Species Average Abundance



Tier I Data Summary:

The six major plant beds identified in Skinner Lake each contained only 1-2 plant species and covered over 3 and 1/2 acres of the lake. Eurasian milfoil was the dominant plant in this survey occurring four times with an average abundance score of three. Curly leaf occurred 4 times with an average abundance of 1. American pondweed, white lily and Illinois pondweed each occurred 1 time and each had an average abundance of 2.

Sago pondweed and naiad were collected in the tier II quantitative survey but were not observed in the tier I survey. This underscores the need for the Tier II survey when trying to accurately describe the aquatic plant community of a lake.

Materials and Methods: Tier II Random Sampling

A extremely important note is that curly leaf pondweed may occur at greater frequencies and at higher densities earlier in the year. Curly leaf pondweed begins to die out as water temperatures approach 70 degrees (Lembi, 1997). This lake was also treated for curly leaf prior to this survey. These two factors indicate that the tier II quantitative survey may underestimate the true distribution and abundance of curly leaf pondweed in Skinner Lake.

Summary:

A tier II quantitative survey of Skinner Lake was conducted on August 26, 2004. The purpose of this survey was to document the distribution and abundance of submersed and floating-leaved aquatic vegetation throughout the lake (Rich 2004). A specific number of sample sites were selected based on the amount of surface acreage the lake possessed. Once sample sites were determined, sampling was accomplished using an aquatic vegetation sampling rake constructed according to the guidelines of the 2004 tier II random sampling procedure manual.

Aquatic vegetation collected at each sample site was sorted according to species, and given a value to represent its abundance at that site. These values were immediately recorded on data sheets distributed by the IDNR. These records were used for data analysis that served to characterize the aquatic vegetation community of Skinner Lake.

Secchi depth was taken prior to the survey and determined to be approximately 2.0 feet. A total of six species of aquatic plants were collected during the tier II survey. Of these species, two of them (Eurasian milfoil and curly leaf pondweed) were exotic species. The average number of total species collected at each sample site was 1.93 while the average number of native species collected at each site was 1.21. The species diversity index for Skinner Lake was 0.76 while the native plant diversity index was 0.67. Average rake density was 1.25 while rake diversity was 0.77. The diversity index of native plants collected on the rake was 0.62.

Eurasian milfoil had the highest average density at 5.0 and had the greatest relative density. It was the most dominant plant in this survey was with a dominance index of 17.1. The next most dominant plant was coontail with a dominance index of 13.6.

Random Sampling:

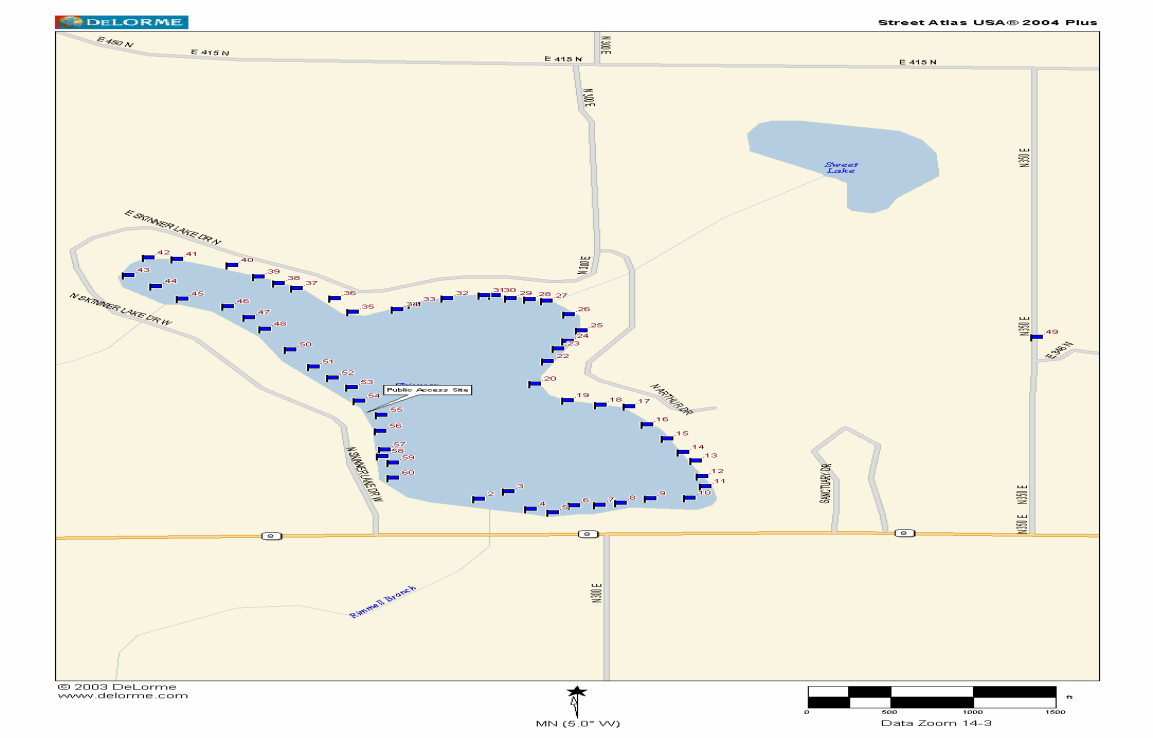
IDNR aquatic biologist Cecil Rich issued the following chart to help determine the number of sample sites needed to accurately describe the aquatic plant community in a lake.

Table 4: Number of Sample Sites Based on Water body Size.

Size of Water body	Number of Sample Sites
1-100 acres	40
101-300 acres	60
Greater than 300 acres	Add 10 sites/100 acres

Based on Skinner Lake's 125 surface acres, 60 sample sites were accurately needed to describe this plant community. Arial photographs and bathymetric maps were used to evenly space the sixty sample sites throughout the lake. The littoral zone of the lake was divided into four quadrants of equal length. During the vegetation collection process, an effort was made to collect plants from 15 sites in each quadrant to ensure that the entire littoral zone was surveyed adequately and that random sample sites were distributed evenly throughout the lake.

Figure 3: Tier II random sampling points



When sampling the littoral zone of the lake, a pattern was used that also helped to ensure an accurate description of the plant community. The littoral zone was divided into three sections based on depth and sample sites alternated between each of these three zones. For example, collection site 1 would be taken in shallow water very close to shore. Collection site 2 would be taken further down the shoreline, but in slightly deeper water. Collection site 3 would be taken further down the shoreline, but in even deeper water, close to the border of the littoral and pelagic (open water) zone. This sampling strategy was recommended by District 3 fisheries biologist Jed Pearson. This strategy not only helps to accurately describe the plants in the littoral zone, but it also aids in determining the maximum depth at which plant can grow in particular lake.

Aquatic Vegetation Sampling Rake:

A double-headed garden rake was used to sample aquatic vegetation. This rake design is approved and used by IDNR fisheries biologists in vegetation surveys on many Indiana lakes. It consists of two garden rake heads welded together back to back so that rake teeth are protruding from two sides. The dimensions of the rake are to be 13.5 inches wide with 2.25-inch long teeth spaced 0.75 inches apart (IDNR, 2004).

Each tooth on the rake head is divided into five equal sections and marked accordingly. These marks on the rake teeth are used to estimate the abundance of plant species when they are collected.

A nylon rope is then attached to the rake head. A black permanent marker is used to mark the rope in foot long increments. A red mark is placed every five feet along the rope. This rope is used to measure the depth at each sample site when the rake is lowered to the lake bottom.

GPS and Mapping:

A WAAS enabled GPS unit was used to obtain and record the coordinates of each sample site on the lake. A WAAS enabled GPS unit is accurate to within 3 meters and was recommended by aquatic biologist Cecil Rich to obtain maximum accuracy for mapping sample sites. All GPS coordinates were then used to produce computer generated maps of the lake with each sample site labeled on the map. A spreadsheet (Table 6) corresponding to this map (Figure 3) is included in this report. The species and abundances at each sample site can be found using the labeled sample sites and the spreadsheet.

Sampling Procedure:

A two-person crew accomplished tier II aquatic vegetation sampling by boat. A crew leader was responsible for driving the boat to each sample site and recording vegetation data on record sheets issued by the IDNR. An assistant was responsible for collecting the aquatic plants using the double-headed rake.

When a sample site was reached, its GPS coordinates were obtained and recorded. The boat was then brought to a complete stop and the double-headed rake was lowered to the bottom of the lake. The boat was held stationary while the water depth at the sample site was obtained by using the marked rope attached to the rake. When water depth had been recorded, the crew leader slowly backed the boat away from the rake as the assistant simultaneously let out another ten feet of rope. During this process the rake did not move from the lake bottom.

The rake was pulled from the water after the boat had reached the end of the ten extra feet of rope let out after the depth was recorded. This ensured that the rake was pulled horizontally through the water, giving it a greater chance of collecting weeds than if the rake had been lowered to the bottom and raised vertically. The vegetation caught on the teeth of the rake was then gathered into the boat.

Determining Vegetation Abundance:

At each sample site, every plant species collected on the rake was scored according to its abundance. This was accomplished by removing all plants from the rake and sorting them by species. Once all plants had been sorted, they were placed back onto the rake and evenly distributed across the marks on the rake teeth. If a species filled the rake to the first mark on the teeth, that species was given a score of one on the abundance data sheet. If it filled the rake teeth to the second mark, it was given a score of two, and so on to a maximum abundance of five. The following maps indicate where three prevalent species were found. Abundance ratings are included beside site markers.

Figure 4: All Tier II sample sites (1-60)

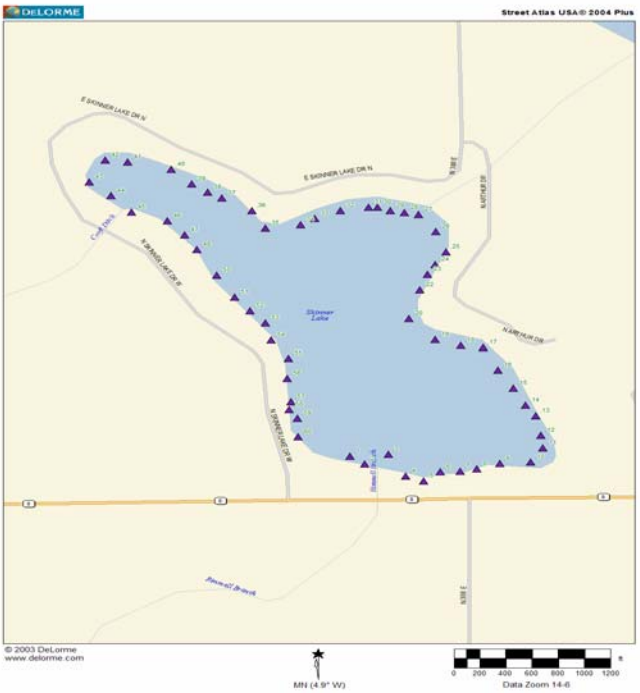


Figure 5: Sites where Curly leaf pondweed was collected.

Figure 6: Sites where Eurasian milfoil was collected.

Figure 7: Sites Where coontail was collected

In many instances it was not necessary to place each species back onto the rake. Many species would fill the rake completely (an abundance of 5) and some species would only have one plant on the rake (an abundance of 1). In addition to abundance scores for individual species, each rake toss was given an overall abundance score, describing how much total vegetation was collected on the rake.

Skinner Lake Tier II Survey Summary

August 26, 2004

Total # of sample sites: 60

Total # of species: 6

Species List

Eurasian Milfoil
Illinois Pondweed
Curley Leaf Pondweed
Coontail
Naiad
Sago Pondweed

Table: 5 Tier II Results Summarized

Species	# of Sites Present out of 60 total sites	Average Abundance
Coontail	18	1.11
Naiad	11	1.36
Eurasian Milfoil	7	3.42
Curley Leaf	13	1.00
Sago Pondweed	4	1.00
Illinois Pondweed	2	1.00

The following table is a summary of data collected during the Tier II vegetation survey. This table was generated using a computer program recommended by the IDNR and describes the same important statistics included in a vegetation survey conducted by IDNR fisheries biologists.

Table 6: Tier II Occurrence and Abundance of Submersed Aquatic Plants.

Occurrence and Abundance of Submersed Aquatic Plants

Date:	8/26/04	Littoral sites with plants:	21	Species diversity:	0.76
Littoral depth (ft):	4.0	Number of species:	6	Native diversity:	0.67
Littoral sites:	28	Maximum species/site:	4	Rake diversity:	0.77
Total sites:	60	Mean number species/site:	1.93	Native rake diversity:	0.62
Secchi:	2.0	Mean native species/site:	1.21	Mean rake score:	1.25

Common Name	Site frequency	Relative density	Mean density	Dominance
Coontail	28.6	0.68	2.38	13.6
Curly-leaf Pondweed	21.4	0.46	2.17	9.3
Eurasian milfoil	3.6	0.86	3.42	17.1
Illinois Pondweed	3.6	0.07	2.00	1.4
Sago Pondweed	14.3	0.14	1.00	2.9
Naiad sp	32.1	0.54	1.67	10.7
Naiad sp	3.3	0.02	0.50	0.3

Comparison with IDNR Vegetation Surveys.

Jed Pearson, district 3 fisheries biologist has provided recent aquatic vegetation surveys for the purpose of comparison with this survey. These additional survey results help to better characterize the plant community of Skinner Lake. This tier II survey conducted by Aquatic Weed Control collected and identified 6 species of aquatic plants. Another IDNR vegetation survey from 2004 also collected 6 species, while two IDNR surveys from June 2003, and July 2003 collected 5 and 6 plant species respectively.

Species diversity measured by Aquatic Weed Control was 0.76. The three species diversity values calculated by IDNR surveys were 0.72, 0.63, and 0.61. While the Tier II surveys of Aquatic Weed Control and the IDNR are extremely similar, the IDNR provides more extensive information and data analysis on emergent plant beds and wetland areas.

It is extremely important to examine the prevalence of curly leaf pondweed in each of these surveys, since it is of special concern in this report. The dominance rating calculated for curly leaf pondweed in this survey (August 26, 2004) is 9.3. A survey conducted by the DNR on July 29, 2004 found curly leaf to have a dominance rating of 5.9. Yet another DNR survey conducted on July 24, 2003 found curly leaf pondweed to have a dominance value of 4.9. All of these values are low and seem to indicate that curly leaf pondweed is not prevalent in Skinner Lake when compared to other plant species. However, the IDNR

survey conducted on June 9 of 2003 shows curly leaf pondweed to have a dominance value of 37.7. This impressive spike in curly leaf pondweed's dominance during the month of June is consistent with common knowledge about its life cycle. Curly leaf pondweed is always extremely prevalent in spring and early summer while water temperatures are below 70 degrees Fahrenheit.

It is clear that the abundance of curly leaf pondweed it not well represented by the July and August surveys. This implies the possible need for more early-season vegetative surveys on Skinner Lake to track the distribution and abundance of curly leaf pondweed, as well as to evaluate future management practices.

Threatened and Endangered Species:

No threatened or endangered species were found during the tier I or the tier II survey. Relatively poor water quality and an abundance of invasive plants are not conducive to the survival of these species (Smith and Smith, 2001). Controlling the invasive plants would promote a healthier ecosystem giving any threatened plants a chance to gain a foothold in this body of water.

Public Involvement:

A public meeting was held by the Skinner Lake Association on November 23, 2004. This meeting was held to inform the public about the problems facing Skinner Lake, and to discuss possible solutions to these problems. Various action plans were discussed and Jim Donahoe of Aquatic Weed Control offered potential management strategies that could be used to control the exotic plants and reclaim the lake for those who wish to enjoy it. A second meeting will be held in January or February of 2005.
The lake association will need to decide if their limited funds are best used on the engineering study or the weeds in the lake. Signs will be posted at the DNR access ramp to educate people and to hopefully reduce the exotic weed species that are coming into the lake.

Education, Monitoring and Evaluation of Plan:

When the action plan is implemented, follow-up surveys will be essential to evaluate the effectiveness of the management activities.

After one year the survey should be conducted to determine the amount of curly leaf turions remaining in the benthos. This will determine if the management strategy has been effective in reducing the curly leaf pondweed population from one year to the next.

In the spring of the third year after the first chemical application, an additional survey should be conducted to determine the amount of curly leaf turions left in the soil. This survey will begin to describe how the curly leaf population is reacting to the management strategy over a longer period of time.

These surveys will provide the basis for evaluation of the management strategy and can be presented to the public should the need arise to modify the management strategy. They will also serve to keep the public interested and informed about Skinner Lake so they will be motivated and equipped to help improve and conserve the quality of the Skinner Lake ecosystem. These survey results should be addressed at a lake association meeting or summarized in a newsletter. This information could also be publicized by posting informative signs about exotic weeds at the lake access points. Additional information can be found at the following web sites: www.mapms.org www.aquatic.org www.apms.org www.nalms.org.

Aquatic Vegetation Management Alternatives

Whole Lake Sonar Treatment

Whole lake Sonar treatment is not the best approach since there is not conclusive evidence that using Sonar will significantly reduce the turion production from one year to the next. Also, if Sonar is used the first year, most district biologists will not issue permits for the lake to be treated the second year so the native plants have a chance to re-establish themselves. Curly leaf pondweed is not a native, so it will also re-grow the second year unless turion production is reduced with Aquathal.

No Action

If no action is taken the exotic weed problem will only get worse since the curly leaf pondweed grows by turions and the milfoil grows by fragmentation. Eurasian milfoil also over winters as an adult plant so new generations are spawned every season, hence the Eurasian milfoil problem only gets heavier if not controlled.

Mechanical Harvesting

Mechanical harvesting is not recommended since Eurasian milfoil has the ability to re-grow by fragmentation when harvested and curly leaf pondweed can leave turions in the soil even when the plant is harvested. Although the cut weeds are removed small fragments still remain, which spread the Eurasian milfoil problem. Also, mechanical harvesting is not selective and it would cut the native beneficial weed species if they were present in the same weed bed as Eurasian milfoil and curly leaf pondweed.

Biological Control

There are no biological control methods for curly leaf pondweed.

Environmental manipulation

Draw down of the lake level is another way to control the curly leaf problem in the lake. Lower water levels expose the curly leaf to freezing and thawing. However, this plan is not selective as it will control the natives as well. Also, this will cause the curly leaf pondweed to grow in deeper water. For these above reasons draw down is not recommended for Skinner Lake.

Action Plan

Skinner Lake is plagued with the exotic weed species Curly leaf pondweed. Curly leaf pondweed was brought to North America sometime between the middle of the 19th century and 1900 and has spread throughout many parts of the United States. This species emerges very early each spring, flowers and sets seed in the late spring and early summer. When the water temperature reaches 70 degrees it dies off on its own. Curly leaf pondweed's main reproduction route is through turion production in the soil. These turions can over-winter in the soil from year to year. Early season treatment is recommended so that the plant is not allowed to produce large quantities of biomass that die naturally when the water temperature hits 70 degrees. (Aquatic Vegetation Management Guidance Manual – G. Douglass Pullman Ph. D) Please remember that the higher the water temperature the less oxygen the water holds. Hence, the more biomass (weed growth) in warm water the more potential risk of a fish kill due to low oxygen levels and stress on the fish. Research by Cerexagri has shown that early treatment with Aquathal reduces turion production from year to year.

Since the curly leaf pondweed comes up early in the year it makes it impossible for the residents to fish or swim. We know this weed is present despite the fact that the survey does not show this primarily because the lake was treated in mid June 2004 and mid August 2004. Over the past 5 years the lake has been treated with contact herbicides in mid June and mid August to temporarily alleviate the aquatic weed problem.

The aquatic weed problem primarily involves the shoreline of the entire lake. We are recommending treating the shoreline areas of the lake. In the past, there has not been a way to control the curly leaf pondweed by the roots. Curly leaf pondweed roots (turions) remain active in the soil for the entire year even though the plant dies on its own after the water temperature reaches 70 degrees.

Recently, Cerexagri (manufacture of Aquathal K) has determined and evaluated on other lakes that treating with Aquathal K in late March to early April when the water temperature reaches 50 degrees will reduce the curly leaf turion production significantly. This application will also control the minor Eurasian milfoil problem. Controlling the milfoil and curly leaf pondweed will allow the more beneficial native weed species to grow.

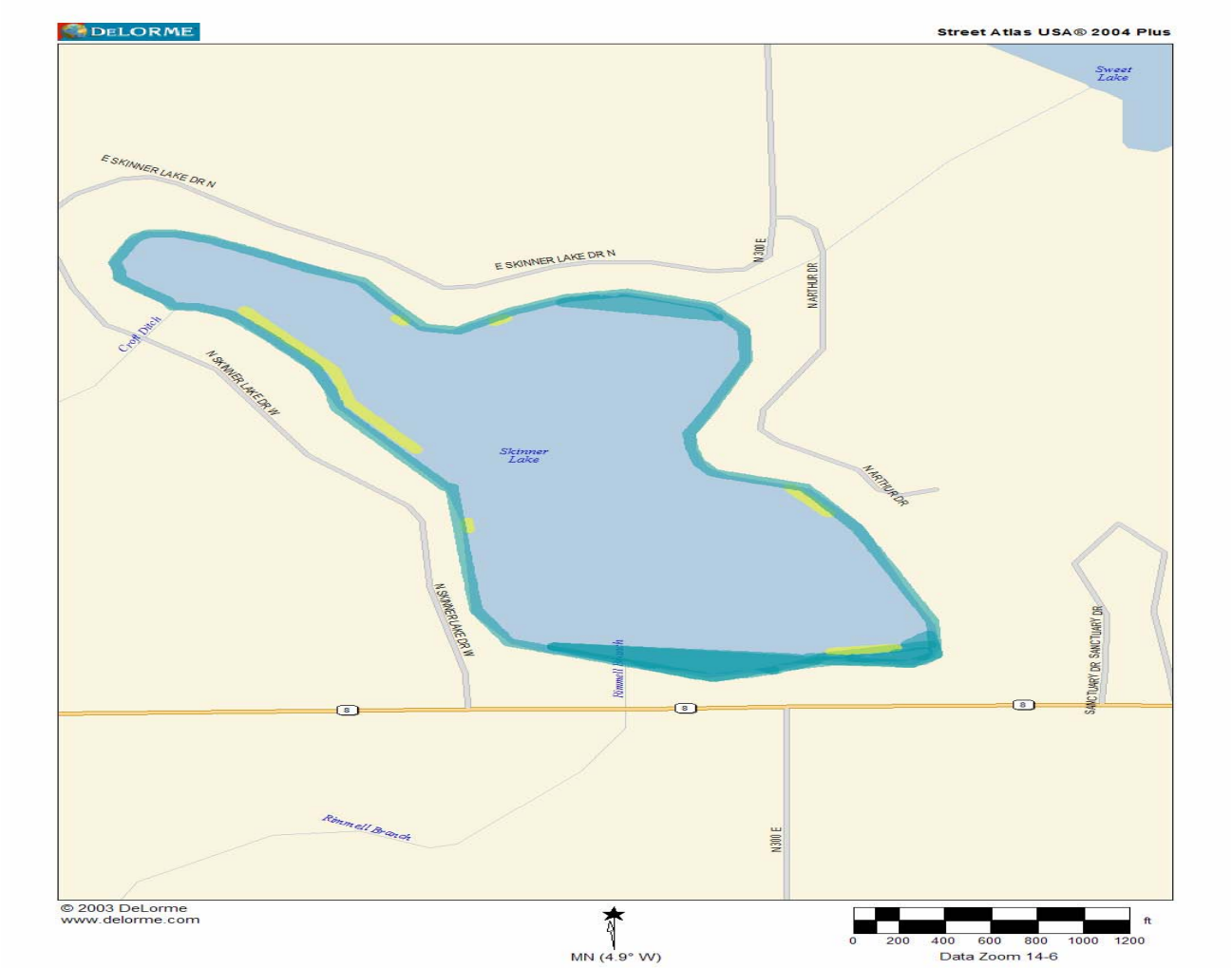
Vegetation sampling would need to be done before the application, and the application would need to be done at least two years in a row to reduce the turion production in the soil. After two years another survey should be conducted to determine if the turion productions is less. It is also important to note that this treatment would is an increase

above the current level of permitted control and permission would have to be granted from the IDNR for the treatment.

A public lake association meeting was held on November 23, 2004 to discuss the problem and this plan where input was received from lake residents. This plan was also discussed with Jed Pearson (biologist in charge of the lake) with the Department of Natural Resources and this approach could be approved as presented at the meeting.

The following map shows the proposed treatment area of skinner lake. As shown, the area around the shoreline will be the primary treatment zone. Poor water clarity in Skinner lake limits plant growth to a depth of approximately 4 feet. Therefore, those shallow depths will receive the most attention. On this treatment map, the area outlined in green will be the primary treatment area. The locations highlighted in yellow indicate areas where curly leaf pondweed was collected during Aquatic Weed Control's August 2004 vegetation survey. Curly leaf pondweed may be extremely abundant in these areas during spring and early summer.

Figure 8: Proposed treatment areas of Skinner Lake.



The lake association should begin to raise funding to spray the lake in 2005 regardless as to whether the association gets a grant or not. In the past, weed control was done on an individual basis and any residents who wanted to spray could by paying to have their lake frontages treated. I would recommend that this money collected every year be used for the 10% match that is required for the LARE funding.

The association is on the right track to help improve their watershed with the engineering study. The association should have fund raisers etc. to help cover the cost of the lake treatment and the engineering study.

Costs over a 5 year Period.

2005 - $12,000 - shoreline of the lake

2006 - $12,000 - shoreline of the lake
Survey Cost: $750.00

2007 - $12,000 - shoreline of the lake.

Any further costs are dependant upon the success of the action plan. At this point, speculation about costs more than three years after the first chemical treatment may not be accurate. Turion production of the curly leaf pondweed should be monitored from year to year. Any further chemical treatments for curly leaf pondweed will be dependant upon turion production in Skinner Lake

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Appendix A: Macrophytes of Skinner Lake

The following appendix was compiled using information found in the 5th edition of How to Identify Water Weeds and Algae, edited by James C. Schmidt and James R. Kannenberg.

Six major species were identified in the tier I and tier II aquatic vegetation surveys.

1. Coontail

Scientific name: *Ceratophyllum demersum*
Classification: Native to Indiana
Distribution: Coontail is common throughout the U.S., usually in hard water.
Presence in Skinner Lake: Collected at 16 of the 60 sample sites.

Description: Coontail plants are submersed and have no roots, though they appear to be attached to the lake bottom when viewed from above the surface of the water. The free-floating nature of coontail allows it to colonize new areas of a lake quickly, and it often times forms extremely dense weed beds where sufficient light and nutrients are available. Coontail has dark green leaves arranged in whorls around the stem and usually grows in long, bushy strands resembling evergreen trees beneath the surface of the water. Coontail's structure is very similar to Eurasian milfoil but coontail has forked leaves, which distinguishes it from the feather-like projections of milfoil leaves.

2. Curley Leaf Pondweed

Scientific name: *Potamogeton crispus*
Classification: Exotic to Indiana
Distribution: Found throughout the U.S. in fresh and brackish water
Presence in Skinner Lake: Collected at 13 of the 60 sample sites.

Description: Curley leaf pondweed usually grows and spreads rapidly in early spring and begins to die out by midsummer as water temperatures approach 70 degrees Fahrenheit. Curley leaf has extremely thin, membranous leaves arranged alternately on the stem with small teeth-like projections visible along the edge of each leaf. A reproductive spike may be seen protruding from the surface of the water. Curley leaf pondweed may also leave small reproductive structures called turions in the sediment on the lake bottom that can lie dormant throughout the winter and then sprout when spring arrives.

3. Naiad

Scientific name: *Najas minor* (brittle naiad)
Classification: Native to Indiana
Distribution: Common Throughout the U.S.
Presence in Skinner Lake: collected at 11 of 60 sample sites

Description: The leaves of naiad plants are usually widest at the base and gradually become thinner near the tip of the leaf. Plants are extremely leafy and appear bush-like when viewed from above the surface of the water. Many species of naiad are very common in this area. Plant structure often resembles Chara, but the absence of calcium deposits on the surface of the plant help in identification. The leaves of brittle naiad have multiple spines along the margins that are visible to the naked eye.

4. Eurasian Milfoil

Scientific Name: Miriophyllum spicatum
Classification: Exotic in Indiana
Distribution: Common in the Midwest and Eastern U.S. Also spreading along the Pacific coast
Presence in Skinner Lake: Collected at 7 of the 60 sample sites.

Description: This extremely aggressive and extremely destructive plant has leaves in whorls of 4 around a reddish stalk. This plant grows rapidly and can reach lengths of over 10 feet. This plant has the ability to over winter, meaning it can lie dormant during the winter months instead of dying out completely each year. This gives it a distinct advantage over many native species, as it competes for sunlight in early spring. The dormant milfoil plants reach the surface much faster than the native plants sprouting from the lake bottom. This enables the Eurasian milfoil to shade out other plants and form the dense beds that choke the littoral zone of many lakes.

A reproductive process called fragmentation aids the rapid dispersion of Eurasian milfoil. If a milfoil plant is damaged and some fragments are removed from the macrophyte, each small piece of the plant has the ability to grow roots and create a new milfoil plant. Eurasian milfoil is considered one of the most dangerous aquatic nuisance species because of its ability to rapidly disrupt and destroy lake ecosystems.

5. Sago Pondweed

Scientific name: *Potemogeton pectinatus*
Classification: Native to Indiana
Distribution: Found throughout the U.S., Very common in the northern 2/3 of Indiana
Presence in Skinner Lake: Collected at 4 of the 60 sample sites.

Description: Sago Pondweed has a bushy appearance with narrow, thread-like leaves that spread out to resemble a fan. Leaves are usually 1/16 of an inch wide and 1 to 6 inches long. Nutlets are formed on a string-like structure and protrude from the surface of the water. While sago pondweed can form dense beds, many times it is found in sparse, loosely distributed arrangements.

6. Illinois Pondweed

Scientific name: *Potamogeton illinoensis*
Classification: Native to Indiana
Distribution: Very widespread and very common throughout the U.S.
Presence in Skinner Lake: Collected at 2 of the 60 sample sites.

Description: Illinois pondweed is extremely common in Indiana, especially in the northern third of the state. This leafy weed has leaves with very broad bases that extend three-fourths of the way around the stem. The upper part of its slender stem is usually branched and very leafy.

Appendix B: Skinner Lake Tier II Vegetation Sampling Data

Table 7: Tier II Survey Point by Site Number

Skinner Lake Tier II Survey Results							
			Plants Present				
		MYSP2	POIL	POCR3	CEDE4	NAFL	POPE6
Site #		Eur. Milfoil	Illinois	Curley leaf	Coontail	Naiad	Sago
1							
2		1			1		
3		5					
4		5			1		
5							
6							
7					1		
8						1	
9				1	1		
10		2		1			
11							
12					1		
13					2		
14		5					
15		1		1			
16							
17				1			
18							
19					1		
20					1		
21							
22						1	
23						3	1
24						3	
25						1	
26							
27							
28		5					
29							
30							

31							1
32							
33				1			
34							
35			1			1	
36			1	1		1	
37					1		
38							
39					1		

			Plants Present				
		MYSP2	POIL	POCR3	CEDE4	NAFL	POPE6
Site #		Eur. Milfoil	Illinois	Curley leaf	Coontail	Naiad	Sago
40							
41							
42							
43							
44							
45							
46				1			1
47						1	
48				1	1	1	1
49					1		
50				1	1		
51					1		
52				1	2	1	
53				1			
54							
55						1	
56					1		
57				1	1		
58				1			
59							
60							
39					1		

Key - 5 is the highest score on the rake.
Blanks indicate Zero weeds on rake
Site Number refers to flag on preceding map.

Appendix C: IDNR Aquatic Vegetation Data Analysis

The following survey summaries were provided by district 3 fisheries biologist Jed Pearson for the purpose of data comparison as well as to help gain a better understanding of the plant community of Skinner Lake.

Table 8: IDNR Tier II survey June 9, 2004

Occurrence and abundance of submersed aquatic plants in Skinner Lake

Date:	6/9/04	Littoral sites with plants:	71	Species diversity:	0.61
Littoral depth (ft):	10.0	Number of species:	6	Native diversity:	0.29
Littoral sites:	95	Maximum species/site:	4	Rake diversity:	0.49
Total sites:	98	Mean number species/site:	1.33	Native rake diversity:	0.23
Secchi:	3.5	Mean native species/site:	0.52	Mean rake score:	2.38

Common Name	Site frequency	Relative density	Mean density	Dominance
Curly-leaf pondweed	69.5	1.88	2.71	37.7
Coontail	43.2	0.66	1.54	13.3
Eurasian water milfoil	11.6	0.16	1.36	3.2
Small pondweed	4.2	0.05	1.25	1.1
Slender naiad	3.2	0.03	1.00	0.6
Illinois pondweed	1.1	0.01	1.00	0.2

Table 9: Tier II survey July 29, 2004

Occurrence and abundance of submersed aquatic plants in Skinner Lake

Date:	7/29/04	Littoral sites with plants:	51	Species diversity:	0.72
Littoral depth (ft)	8.0	Number of species:	6	Native diversity:	0.53
Littoral sites:	91	Maximum species/site:	3	Rake diversity:	0.71
Total sites:	104	Mean number species/site:	0.84	Native rake diversity:	0.50
Secchi:	2.5	Mean native species/site:	0.47	Mean rake score:	1.52

Common Name	Site frequency	Relative density	Mean density	Dominance
Coontail	30.8	0.34	1.11	6.8

Curly-leaf pondweed	29.7	0.30	1.00	5.9
Slender naiad	8.8	0.09	1.00	1.8
Eurasian water milfoil	6.6	0.08	1.17	1.5
Sago pondweed	5.5	0.05	1.00	1.1
Variable pondweed	2.2	0.02	1.00	0.4

Appendix C. Continued

Table 10: IDNR tier II survey June 24, 2003

Occurrence and abundance of submersed aquatic plants in Skinner Lake

Date:	7/24/03	Littoral sites with plants:	64	Species diversity	0.63
Littoral depth (ft):	8.0	Number of species:	5	Native diversity	0.23
Littoral sites:	94	Maximum species/site:	3	Rake diversity	0.54
Total sites:	105	Mean number species/site:	1.04	Native rake diversity	0.19
Secchi:	4.0	Mean native species/site:	0.65	Mean rake score:	1.80

Common Name	Site frequency	Relative density	Mean density	Dominance
Coontail	56.4	0.99	1.75	19.8
Curly-leaf pondweed	24.5	0.24	1.00	4.9
Eurasian water milfoil	14.9	0.19	1.29	3.8
Slender naiad	6.4	0.10	1.50	1.9
Fries' pondweed	2.1	0.02	1.00	0.4